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ABSTRACT

A comparison between achievement test scores in a life science course for students in audiotutorial sections and those in conventional lecture-laboratory sections was made during the fall of 1973. The comparison indicated that student achievement, as measured by percentage scores on unit tests plus a final examination, was almost identical between the two types of instruction. However, the audiotutorial students were able to complete additional supplementary minicourses of their choice within the same time span; hence, in reality they were able to achieve more by the individualized instruction. Furthermore in responding to an attitude questionnaire, students indicated a preference for this type of learning experience. Taking confidence from these results and combining that information with the experience gained through field testing minicourses from Purdue University, the Lake Land College Life Science staff has implemented an expanding program of supplemental packaged units (minicourses). (Author)

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A B S T R A C T

AUDIO-TUTORIAL INSTRUCTION AND STUDENT-SELECTED CURRICULA

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Life science instruction at Lake Land College, Mattoon, Illinois has utilized a Postlethwait-type of audio-tutorial instruction for over four years. A comparison between achievement test scores for students in audio-tutorial classes and those in conventional lecture-laboratory sections was made during the fall of 1973. This comparison indicated that student achievement, as measured by percentage scores on unit tests plus a final exam, was almost identical between the two types of instruction. However, the audio-tutorial students were able to complete additional supplemental minicourses of their choice within the same time span; hence, in reality were able to achieve more by the individualized instruction. Furthermore in responding to an attitude questionnaire, students indicated a preference for this type of learning experience. Taking confidence from these results and combining that information with the experience gained through field testing minicourses from Purdue University, the Lake Land College Life Science staff has implemented an expanding program of supplemental packaged units (Minicourses). Utilizing these, the future student will be able to plan his own course with considerable freedom and flexibility of topics, beginning and completion dates, and amount of credit earned.

AUDIO-TUTORIAL INSTRUCTION AND STUDENT-SELECTED CURRICULA

INTRODUCTION

Do students studying by audio-tutorial methods achieve as well as students in a conventional classroom? Biology instructors in the Life Science Department at Lake Land College, Mattoon, Illinois, have an answer to this question and are investigating additional personalized instructional techniques.

There are many college teachers who are already enthusiastic audio-tutorial (A-T) advocates. No doubt they feel that achievement through A-T instruction is definitely equal to if not superior to other instructional techniques. Nevertheless, there is little real data to support such feelings or other allusions to various inferred advantages of A-T methods.

Life science instruction for the biology at Lake Land College is somewhat unique in that students can choose between A-T taught sections or conventionally taught lecture-laboratory (L-L) sections. Since the material covered is almost identical, the opportunity for comparison of effects between instructional methods was enticing. Although there had been previous cursory comparisons made by Lake Land Life Science instructors, the first comparisons with deliberate attempts to control variables were made during the fall quarter of 1973. The results should give positive encouragement to efforts by anyone wishing to promote A-T instruction. For Lake Land College the door has certainly been opened to further applications of instructional technology in the future.

A-T LIFE SCIENCE AT LAKE LAND COLLEGE

Justification for considering a new pattern of instruction for Life Science at Lake Land College came basically from Postlethwait,

Novak, and Murray (1969) with additional support for new and untried techniques from other sources. Klausmeir (1961) expressed the opinion that most persons never come close to reaching their potential capacity of learning. Consequently, new instructional challenges beyond those normally offered, were considered as appropriate to present to Lake Land students. Smith and Smith (1966) have expressed the idea that man has not always been as intelligent nor as rapid a learner as he is now, since he has not had the present potential.

The time was ripe for pioneering, the staff was enthusiastic, and so A-T biology instruction was initiated in 1970 at Lake Land College. Since that time the pattern established has been to present the introductory Life Science course via A-T during the fall quarter, General Zoology for the winter quarter and General Botany in the spring. From the beginning, students were permitted to enroll in either the A-T or the conventional lecture-lab sections of the course. Typically, approximately 75% would select the A-T, which is presented in a 24-carrel lab in a manner similar to the basic pattern established by Postlethwait at Purdue University. Reasons for the student preference for A-T would include the following:

(1) A-T offers more flexible scheduling. With the A-T lab open from 8 am to 9 pm, the student can arrange his own class time for the week except for the general assembly session on Monday and the small discussion session on Friday. This plan is especially attractive to students with either full or part-time employment (53% of Lake Land's students are employed).

(2) The student can "individualize" his learning to the extent that he can spend as much time as he "needs" repeating either all or portions of the tape, or in some cases he can spend as little time as he feels necessary to get by.

(3) A full-time life science instructor is always present in the A-T lab so that the student has more opportunity for one-to-one direct question-answer or discussion sessions than is usually possible in the conventionally taught biology class.

(4) Most students fresh out of high school are eager to try anything different from the type of instructional procedures they have been subjected to for the previous twelve years.

On the other hand those students who are more likely to prefer the conventional type instruction favor feel comfortable with that to which they are accustomed and have previously succeeded. When recognized by the student, the factor of unwillingness to assume full responsibility for planning one's time, tends to channel that individual toward the conventionally-taught class. When unrecognized by the student, this factor probably accounts for the major portion of the failures and drop-outs that occur among the A-T students. They simply are not yet capable of handling their new freedom.

THE EXPERIMENT

At Lake Land College there are eight full time life science instructors, all of whom are scheduled part-time in A-T and part-time in conventional instruction. During the fall quarter of 1973 one instructor was assigned to three conventional introductory life

science classes, two of which met during the day and the other one two nights per week. Each of these three classes met six hours per week for four quarter hours credit. These three conventionally taught lecture-lab (L-L) classes (a total of 60 students) comprised the basis of comparison to the A-T students (total 203).

The A-T students and the L-L students had the following characteristics in common:

(1) The same list of instructional objectives for each of eight common basic units comprising the Life Science course.

(2) The same study guide, written by the Lake Land College, Life Science Staff.

(3) The same textbook: Basic Concepts of Biology by Nelson, Robinson, and Boolootian, second edition.

(4) Identical beginning date, finishing date, and college transfer credit (four-quarter hours).

(5) Alternate forms of the weekly unit exams of 40-50 questions each.

(6) The same final exam (80 test items) given simultaneously.

(7) The same building, lab equipment, supplies, and audio-visual aids, including numerous 16mm films.

(8) The same pretest of 40 items from the Purdue Minicourse Evaluation Project, to verify that all students initially were indeed from the same population in regard to their biological knowledge.

TABLE I. PRETEST OF BIOLOGICAL KNOWLEDGE

	No. of Students	Mean Score	Standard Deviation
L-L	60	8.69	4.92
A-T	203	8.14	4.77

t = .78

With 261 degrees of freedom, at the .05 level there was no significant statistical difference between the groups on pre-achievement test scores.

(9) The same pre-attitude test of 22 items (from the Purdue Minicourse Evaluation Project) to verify that all students initially held basically the same attitudes toward biology.

TABLE II. PRETEST OF ATTITUDES TOWARD BIOLOGY

	No. of Students	Evaluated Mean Score	Standard Deviation
L-L	203	80.7	12.3
A-T	60	77.1	13.3

t = .29

With 261 degrees of freedom, at the .05 level there was no significant statistical difference between the groups in their attitudes toward biology prior to the experiment.

Differences between the A-T section and the L-L sections included the following:

(1) A-T students were scheduled for one class period on Monday (GAS), primarily for testing, and one on Friday, the small discussion session (SDS). Sometimes there were films shown for all to see at some announced time. Other time spent in attempting to meet the course objectives was at the descretion of the individual student, but they were encouraged to spend a minimum of three addit-

ional hours per week in the A-T lab. The conventional L-L sections each met six hours each week in a combination of lecture, laboratory, discussion and testing that varied somewhat from week to week.

(2) Each A-T student was required to complete a minimum of four supplemental minicourses of his own choice. The conventional L-L sections had no such assignments nor exposure to these materials at all.

(3) Time-wise, the L-L sections tended to gradually run more and more behind the A-T sections in completing each weekly unit. This did not mean that any difficulties would develop in completing the course material since the L-L classes had the extra week at the end of the quarter when the A-T sections worked with the supplemental minicourses.

(4) The 60 L-L students comprising the population for this comparison study all had the same instructor. The A-T students were divided among eight instructors, including the L-L instructor mentioned above, for their small discussion groups and for grading purposes. Each of the eight basic weekly taped units was prepared by a different instructor.

ACHIEVEMENT RESULTS

Table III shows the average percentage scored for all students in the two groups. All test items were very similar, if not identical. All tests were administered within a span of no more than three days with the same final being given at the same time to all students in both groups.

TABLE III. AVERAGE ACHIEVEMEMT TEST SCORES (INCLUDING FINAL EXAM)

	No. of Students	Ave. Percentage Scores (Means)	Standard Deviation
L-L	52	78.00	3.91
A-T	153	79.54	10.06

$t = 1.84$

With 203 degrees of freedom, the t-test demonstrated the means (average percentage scores) were not statistically different at the .05 level

The conclusions that can be drawn from the above data would include the following:

(1) Students in the two groups (A-T and L-L) achieved equally well on the assigned basic unit tests and final. There was no significant difference in their average achievement scores.

(2) Most students in A-T classes completed an additional four or more supplemental minicourses within the same time span that L-L students completed only the basic units. These results substantiate an earlier study by Garren (1970) which demonstrated that students can achieve more when utilizing individualized instruction and working with varied science topics.

GRADE AVERAGE COMPARISONS

On the basis of average percentage scores, a letter grade was assigned to each student at the end of the quarter on the following scale:

A	90 - 100%
B	80 - 89%
C	70 - 79%
D	60 - 69%
F	0 - 59%

Grades of "W" (withdrawal) may be requested by Lake Land students at any time during the quarter up to one week before final exams. Grades of "W" do not appear on the student's transcript. Grades of "I" (incomplete) may occassionally be assigned to individuals who, with a passing average because of reasons such as illness, do not complete the course within the normal time.

TABLE IV: PERCENT OF STUDENTS RECEIVING GRADE

	A	B	C	D	F	W	I
L-L	18	20	34	10	10	8	0
A-T	13	25	25	8	7	21	1

While grades alone can be considered only a partial measure of the success of an instructional technique, the data in Table III is nevertheless interesting. The total number of students here is too small for profound conclusions but note that the combined percentages of grades A and B is 38% for both instructional methods. One might infer from this that the good student achieves irregardless of the instructional method. Hence, the advantage of A-T instruction in the comparison at Lake Land came from the additional knowledge gained through the supplemental minicourses which were completed within the same time span.

The higher percentage of withdrawals among the A-T population reflects the casual approach many less-self-motivated community

college students demonstrate toward formal instruction of any type. This factor is more likely to be evident with less structured classwork. When they procrastinate their A-T learning, they tend to follow a pattern of gradually falling farther and farther behind and subsequently withdraw before the end of the quarter, the ease of which was previously pointed out. However, many of these students will return to try again sometime later.

STUDENT ATTITUDE TOWARD A-T INSTRUCTION

During the 1973-74 winter quarter, students enrolled in several biology classes at Lake Land completed a questionnaire regarding their preference as to instruction techniques. The data shown in Table IV is from students who were taking at least a second course (either General Zoology or General botany). One should not assume that every individual is enrolled in his first choice of type of instruction. Once in a while conflicts prevent this, although hopefully, rarely so.

TABLE V: STUDENT PREFERENCE OF INSTRUCTIONAL METHOD

Sequence of First Two Life Science Courses*		A-T to A-T	A-T to L-L	L-L to A-T	L-L to L-L
Preference For Third Life Science Course	A-T	73%	52%	60%	0%
	L-L	27%	48%	40%	100%
No. of Students		45	19	10	8

* Indicates sequence that student took the two courses, i.e. A-T to L-L means that the student first had a life science course by A-T followed by a L-L course in zoology or botany.

The data in Table V would seem to indicate that most students endorse the type of instruction they have already selected and would select the same for another course. Note also that nearly three-fourths of those students enrolled in their second A-T biology course indicated a preference for A-T instruction for their next course. Those in L-L classes seem more completely dedicated to the instructional method they have chosen. Finally, although the sample was small (29 students), those having enrolled in both one A-T and one L-L biology class, the majority preferred A-T for their next class.

STUDENT SELECTED CURRICULA

In total then, the analysis of the data taken from the comparison of the students in audio-tutorial (A-T) sections and students in conventional lecture-laboratory (L-L) sections has shown that overall course grades and basic knowledge gained in the course show little difference between the two groups. One benefit gained through the use of A-T techniques in teaching life science has been pointed out. Students in the A-T program completed the same course materials in approximately one week's less time. While the L-L classes were still completing the basic course materials, the A-T students were engaged in work on their optional supplemental minicourses, thereby furthering their knowledge in the particular science topic in which they were more interested.

The life science course is a degree requirement course for everyone who seeks an associate of science degree from Lake Land College. The concept of adapting optional, supplemental minicourses to complete this course is actually the first step a student can

take in self-designing a required course to fit his particular needs or curriculum demands. Through the further implementation of minicourses into the basic units which make up the life science course, theoretically a student could totally design the course to his needs. Thus, the ultimate goal is to have the life science course which is totally individualized to the wants and needs of the student. The minicourse approach to individualized course design seems to work best using an A-T format, since self-pacing is desirable. Under a conventional L-L class presentation, timing becomes too rigid to allow completely individualized instruction to take place.

Lake Land College began using minicourses in the A-T biology curricula approximately three and one-half years ago when the life science department became associated with the Purdue Minicourse Development Project as a field testing station (Postlethwait and Russell, 1971). Initially the Purdue minicourses were substituted for a comparable unit in the A-T course at Lake Land. Gradually, as more and more minicourses were completed for field testing by the Purdue Minicourse Development Project, it became impossible to simply keep on substituting one of Purdue's minicourses for one of the basic units in the A-T life science curriculum at Lake Land. Because many of Purdue minicourses were limited to special topics, the life science staff felt that the basic units at Lake Land were more appropriate for the typical Lake Land student. Therefore, some Purdue minicourses as well as many new minicourse topics d signed and developed by Lake Land staff members were implemented

as supplemental materials to the basic A-T life science courses. This innovation incorporated truly individualized flexibility into course design, a concept greatly appreciated by both the non-science as well as the science majors.

Incorporating this minicourse technique, Lake Land students enrolled in either life science (biology), general botany, or general zoology are still required to complete a basic set of eight units for each course. In the remaining time, usually at the end of the quarter (one to two weeks) the A-T students are required to complete four additional minicourses. In this way, the student is given a choice of the topics into which he wished to further delve.

At the present time, the Lake Land life science staff has forty optional minicourses from which the students can choose. (See Appendix I) These minicourses are catalogued as either life science, general botany, or general zoology minicourses in our minicourse library. At their own conveniences students can check out minicourse modules consisting of a tape, study guide, objectives, laboratory equipment, and various other lab soft wares and audio-visuals. All the student has to do is to contact the instructor monitoring the A-T lab at that given time. Having completed the minicourse, the student simply checks the minicourse module back into the A-T lab instructor who replaces it in the minicourse library.

Several methods have been employed for establishing a practical means by which students are tested or graded on minicourses. Written test, oral tests, projects or collections, short research papers, or combinations of these have been employed at Lake Land. A file

containing several different forms of written tests for each minicourse was established in the minicourse library. Once the student feels that he or she can satisfactorily answer the minicourse objectives, he goes the A-T lab instructor and requests that minicourse test. This testing or grading flexibility is especially important to the non-major who feels the threat of time may hinder his grade or performance in a course that he is required to take as part of his own degree requirement. Once the student's instructor has graded the particular minicourse, the minicourse grade is placed in a central grade file for reference to prevent repetition of identical minicourses in another A-T life science course taken at a later date.

Using the A-T format, optional, supplemental minicourses need not be limited only to indoor A-T lab activities. Natural science courses are well adapted to the use of outdoor laboratory areas. Through the use of portable cassette tape recorders and a self-instructional, nature trail, study guide booklet, A-T students are able to study the local flora, fauna, and different points along our nature trail. Other minicourses incorporating the outdoor laboratory areas include using a tractor and hay rack to carry the students directly to different areas of the campus to observe a variety of conservation practices. Another minicourse, entitled "Pond Management" had it's small discussion session at one of the campus lakes where the students participated in a pond survey which included a fish-shocking demonstration. Minicourses can also be designed to meet the needs and interests of the handicapped student,

since traditional life science courses often create insurmountable problems to the student confined to a wheelchair or with other such handicaps.

Under the A-T format, optional, supplemental minicourse modules are limited only by one's imagination. Although having barely scratched the surface on the use of closed circuit TV for minicourses, the future plans at Lake Land look enthusiastically toward the incorporation of this tool with minicourses. The idea is to have an A-T student simply pick up a phone and order a prerecorded closed circuit TV minicourse at his convenience. With the aid of a computer to keep a test bank and the student's grades, total flexibility could be achieved. An A-T student could begin an A-T course at any time, choose his own set of minicourses to meet his curriculum program or interests, and then be able to complete the course at a time convenient to his own schedule. A system of variable credit is anticipated for those students not completing a full set of course units or minicourse requirements.

CONCLUSIONS

It has been demonstrated that the use of audio-tutorial minicourse techniques has augmented student progress toward his goal of acquiring a degree as well as supplementing his quest for greater amounts of knowledge relevant to his career goals and special interests. Through the further use of audio-tutorial methods and minicourse techniques, students will eventually be totally individualizing and self-designing their own life science courses at Lake Land College.

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APPENDIX I

OPTIONAL SUPPLEMENTAL MINICOURSE LISTING

LIFE SCIENCE	GENERAL ZOOLOGY	GENERAL BOTANY
Succession The Metric System Conservation Practices at LLC Territoriality Energy - Can We Meet the Demand? DNA Duplication and Protein Synthesis Vegetative Reproduction Building With Bonds The Nature of Water pH and Buffers Gametogenesis Human Heredity Evolution of Man I Evolution of Man II Human Chromosomes, Sex Determination, and Sex Chromosomal Abnormalities Drugs and You	Parasitism Social Insects Animal Behavior Bone Development and Diseases of the Skeletal System Blood Typing and the RH Factor Diabetes Chemical Digestion in Humans Sense Organs Venereal Diseases Animal Migration	Lawn Care Indoor Plants Edible Plants Preparation and Maintenance of a Terrarium Pruning Techniques Fruit Types Grafting Techniques Wine and Alcoholic Fermentation Plantings to Attract Birds Tree Identification Spring Flower Identification Aquactic Plants (Algae) Fungi Ecology and Succession